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### HABITAT USE OF CROWNED EAGLES (*HARPYHALIAETUS CORONATUS*) IN THE SOUTHERN LIMITS OF THE SPECIES' RANGE

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**KEY WORDS:** *Crowned Eagle*, *Harpyhaliaetus coronatus*; *habitat use*, *Argentina*.

The breeding range of the Crowned Eagle (*Harpyhaliaetus coronatus*) is limited to semi-open woodlands in lowlands and moderate altitude mountain ranges of Argentina, Bolivia, Brazil, Paraguay, and Uruguay). It is a large-sized, open country raptor that eats a variety of vertebrate prey species. There are over 112 sight records for the species, most of them from Argentina over the past 50 years, including relatively recent encounters in Lihue Calel (province of La Pampa) in the southern limit of the species' range (Collar et al. 1992, De Lucca 1992 and 1993). Based on this, it appears that the Crowned Eagle mainly occurs in the northcentral part of the country, in open woodlands and savannas. Three nests have been described in Argentina. All contained a single egg (Giai 1952, de la Peña 1992). The Crowned Eagle has been protected in Argentina since 1954 and in Brazil it is listed as a Threatened Species (Chebez 1994). Little is known, however, about its ecology and behavior (Collar et al. 1992, Salvador and Eroles 1994, Gil et al. 1995).

Here, we provide new information on the Crowned Eagle's habitat requirements by describing the habitats it uses for roosting and nesting in the southern limits of its range.

#### MATERIALS AND METHODS

Our study was conducted during 1996–97 in an area covering approximately 5000 km<sup>2</sup> centered in Lihue Calel National Park (37°54'S, 65°39'W), province of La Pampa, Argentina. The area is situated at the ecotone between savanna dominated by *Prosopis caldenia* and shrubland dominated by *Larrea* spp. Since the 19th century, the natural landscape has been gradually modified by afforestation followed by extensive ranching. Currently, natural woodlands occur primarily in depressions and ravines, and shrublands with isolated *P. caldenia* or small woodlots characterize the landscape. Fire is a common natural disturbance and it is often prescribed to improve grass productivity. The climate is semiarid; mean temperature of the warmest and coolest months is 25°C and 9°C, respectively, and the mean annual precipitation is 414 mm.

Because we expected the Crowned Eagle to be difficult to see, we conducted both road surveys and interviews with local farmers to locate eagle roosting areas. Additionally, staff at the Lihue Calel National Park was instructed to look for and report any encounter with Crowned Eagles. Road surveys were conducted along six 50-km transects, completing one observation stop of 5 min every 0.8 km (Fuller and Mosher 1987). Surveys were performed by the same observers, during 18–24 November 1996 from 600–1300 H. A total of 20 farmers were interviewed. We asked them whether they had seen Crowned Eagles. If the answer was yes, we asked for a description of the animal. If the description fit a Crowned Eagle, we proceeded to fill out a questionnaire asking the following questions: (1) When did you see the eagle?; (2) Where did you see it?; (3) In what type of habitat?; (4) From where did you see the eagle?; (5) Was the eagle dead or alive?; and (6) What was the eagle doing? After completing the questionnaire, we asked farmers to bring us to the exact locations where eagles were observed. The following variables were recorded in 1-ha square plots centered on the points where eagles were seen: habitat type, number of vegetation strata, canopy cover, canopy height, dominant tree species, shrub cover, shrub height, dominant shrub species, understory cover, understory height, and dominant herbaceous plants.

#### RESULTS AND DISCUSSION

Three new records for the Crowned Eagle were reported by staff of the National Park of Lihue Calel in 1996–97. On 18 November 1996, an eagle was observed perched in a tree approximately 20 km east of the Lihue Calel National Park. A second sighting was made on 22 November 1996 approximately 40 km southeast of the park. The third sighting was of a subadult Crowned Eagle on 21 September 1997 perched in a *Prosopis* tree in the park.

No Crowned Eagles were recorded during road surveys. Of the 20 farmers interviewed, 10 said they had seen Crowned Eagles and their descriptions fit the eagle's features. All of the farmers referred to the large size and head feathers, and most of them recalled the eagle's

characteristic whistle and reluctance to fly off when approached. Eagles were encountered while farmers were walking (40%), driving (30%) or riding horses (30%). Most eagles were observed in natural woodlands (50%) or near *tajamares* (40%, artificial ponds surrounded by trees that provide water for cattle). Eagles were seen perched (80%), flying (10%) or perched and eating. Four encounters were not considered in the analysis, one of them because it had occurred about six years prior to the interview (all other sightings were in 1996–97). The remaining three cases were not used because farmers were unable to determine the exact location where they saw eagles. No farmer recalled the encounter date and no dead eagles were reported.

Vegetation in all roosting habitats consisted of three strata. The dominant tree species was *P. caldenia*. Canopy cover was  $37 \pm 18\%$  ( $\bar{x} \pm 1$  SD) and canopy height was  $6.2 \pm 2.6$  m. Dominant shrub species were *Larrea nitida* (present in 67% of the described sites), *Lycium chilense* (17%) and *Prosopis flexuosa*. Other shrub species included *Larrea divaricata* (in 67% of the sites), *Condalia microphylla* (67%), *Chuquiraga erinacea* (50%), followed by *Geoffroea decorticans*, *Schinus fasciculatus*, *Prosopidastrum globosum* and *Lycium gilliessianum*. Shrub cover and height were  $17 \pm 16\%$  and  $1.6 \pm 0.2$  m, respectively. The understory was dominated by grasses (*Stipa gynerioides* and *S. tenuissima*) in five of the described sites, and by *Verbena aspera* in the remaining site. Sites where Crowned Eagles were seen roosting or nesting appeared to be similar to the typical *tajamar* or woodlots in the area, but different from the matrix of the shrubland landscape.

One nest site was found as a result of our interviews. The nest had been partially destroyed in the summer of 1996 and it did not show any sign of activity on our visit in February 1997. It was located approximately 12 km east of the National Park in a natural  $2 \times 4$  km forest of *P. caldenia* crossed by a stream. Habitat surrounding the nest tree had 45% canopy cover and a canopy height of 7 m. The middle stratum was dominated by seedlings of *P. caldenia* and by shrub species such as *L. chilense*, *P. flexuosa*, *G. decorticans*, *S. fasciculatus*, and *C. microphylla*. Mean shrub cover was 25% and mean height was 1.5 m. The understory was dominated by *Stipa gynerioides*, *S. tenuissima*, and *Bacchari ulicina*. Percent cover of herbaceous plants was 25% and height was 0.4 m. The nest was a large platform of sticks placed 6 m high in a 12 m *Prosopis* tree. It was supported by two branches and was built with *Prosopis* branches that measured 0.6–2.2 cm in diameter. Previously, Gai (1952) described two Crowned Eagle nests built on communal nests of Monk Parakeets (*Myiopsitta monachus*) and De la Peña (1992) described a large platform nest 5 m up in an *Eucalyptus* tree. Our results show that Crowned Eagles may build nests in shorter and less conspicuous trees than those dominating northern savannas.

Our sightings were consistent in that Crowned Eagles were observed using primarily *P. caldenia* for roosting and

habitats that provide for tree, shrub and grass cover. The southern limit of the species' range appears to be at the ecotone between the phytogeographic provinces of *Espinal* and *del Monte*, that occur through the NE–SW gradient of decreasing mean annual precipitation in Argentina. The *Espinal* is a savanna dominated by *Prosopis* sp. and *del Monte* is characterized by shrublands dominated by *Larrea* sp. with isolated *Prosopis* and isolated woodlots occurring mainly in depressions and ravines.

Crowned Eagles seem to depend on the presence of trees because they do not occur south in the Patagonian steppe. In the southern limit of its range, the Crowned Eagle occurs in a fairly transformed landscape characterized by shrublands with isolated groups of native trees providing nesting and roosting habitats. This finding has conservation implications for Crowned Eagles. Current land management in the area includes afforestation followed by ranching. Creation of extensive areas lacking trees or having isolated trees may result in the reduction of the eagle's range. Conservation efforts should include the provision of native woodlots due to their importance for Crowned Eagles.

RESUMEN.—En este estudio aportamos nueva información acerca de los requerimientos de hábitat del águila coronada (*Harpyhaliaetus coronatus*), a través de la descripción de los sitios usados como posadero en el límite sur del área de distribución de la especie. Adicionalmente, aportamos tres nuevos registros y describimos un nido. Los sitios donde las águilas fueron vistas eran similares a un típico *tajamar* (laguna artificial rodeada de árboles) o a un monte, pero diferentes a la matriz del paisaje de tipo arbustiva. La vegetación presentaba tres estratos, donde *Prosopis caldenia* (caldén) era la especie arbórea dominante. La cobertura de la canopia era de  $37 \pm 18\%$  (promedio  $\pm 1$  DE) y la altura de  $6.2 \pm 2.6$  m. Las especies arbustivas dominantes eran *Larrea nitida*, *Lycium chilense* y *Prosopis flexuosa*. La cobertura y altura de arbustos era de  $17 \pm 16\%$  and  $1.6 \pm 0.2$  m, respectivamente. El estrato bajo estaba dominado por pastos. La creación de áreas extensas sin árboles o con árboles aislados podría resultar en la reducción del área de distribución de la especie. Esfuerzos de conservación requerirán de un manejo del hábitat que provea grupos de árboles nativos.

[Traducción de Autores]

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## A COMPARISON OF METHODS TO EVALUATE THE DIET OF GOLDEN EAGLES IN CORSICA

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Identification of prey remains, pellet analysis and direct observation of prey deliveries are the principal methods used to study the diets of nesting raptors (Marti 1987). Although it is often best to observe or film nests for long periods to quantify prey deliveries, this is not always possible due to time and logistical constraints. To assess the validity of using prey remains and pellets as a means of determining diet, several authors have compared data from collections of nest contents with data obtained from direct observation for various raptor species (Collopy 1983, Simmons et al. 1991, Mersmann et al. 1992, Mañosa 1994, Real 1996). Overall, they have found that by combining remains and pellets, collected with the same level of effort, it is possible to determine

diet. Previous studies of the diet of Golden Eagles (*Aquila chrysaetos*) in the Mediterranean area have been based on the collection of prey remains, without taking into account any possible biases in the data collected using only this technique (Handrinos 1987, Cheylan 1983, Fasce and Fasce 1984, Fernandez 1991, Grubac 1987, Huboux 1984). Considering that the variety of food resources on Mediterranean islands is limited (Seguin and Thibault 1996) with a moderate spectrum of potential prey, we conducted this study to determine the best methods for monitoring the diet of Golden Eagles on Corsica.

### STUDY AREA AND METHODS

Corsica (42°N, 9°E) is one of the major islands in the western Mediterranean covering an area of 8750 km<sup>2</sup>. It supports a breeding population of 32–37 pairs of Golden Eagles (Torre 1995). Our study area, in the Verghello